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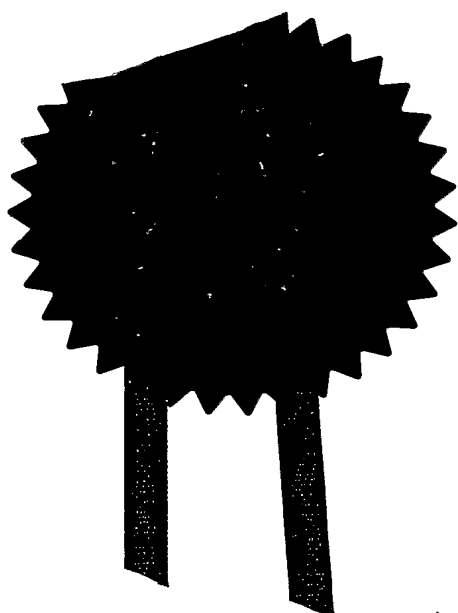
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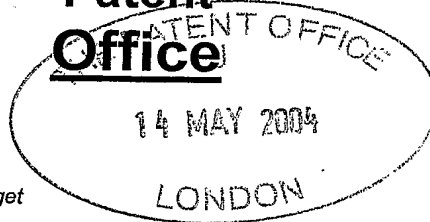
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4. Title of the invention	Toothbrush		
5. Name of your agent (if you have one) "Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode) Patents ADP number (if you know it)	Corporate Intellectual Property GlaxoSmithKline Corporate Intellectual Property (CN9 25.1) 980 Great West Road BRENTFORD Middlesex TW8 9GS 8072555006		
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Toothbrush.

This invention relates to toothbrushes, in particular to toothbrushes having flexibly mounted bristles.

Typically a toothbrush comprises a head and a grip handle disposed along a head - handle longitudinal direction, optionally with a neck longitudinally between the head and handle. Typically the head is elongate in line with this longitudinal direction, has a tip end longitudinally remote from the handle, and a longitudinally opposite base end closest to the handle. Typically the head has a surface from which bristles extend, the "bristle face", in a bristle direction transverse to, typically generally, perpendicular to the longitudinal direction. Typically the head has a width direction transverse to, typically generally, perpendicular to both the longitudinal and bristle directions.

It is generally known to make the head flexible so that the head can respond to pressures applied to the bristles by resilient flexible deformation to cushion excess brushing pressures and to allow the bristles to accommodate themselves to the profiles of the teeth.

Toothbrushes are known having the ends (the "proximate" end) of their bristles which are fixed into the head flexibly mounted in contact with a resilient elastomer material membrane. DE-A- 41 22 524 A discloses a toothbrush in which the proximate ends of bristles are mounted on a plate, the reverse side of which is in contact with an elastic pad. DE-U-201 09 123 discloses a toothbrush head having bristles mounted in plural longitudinally arranged plastics material segments flexibly linked together, and mounted across the concavity of a supporting "bow". JP-A-13025411 discloses a toothbrush head with bristles mounted on a flexible plate across a concave backing and passing through holes in a guide plate. US-A-2,706,825 discloses a toothbrush with a concavely curved head the two longitudinally disposed ends of which support a demountable bristle carrier which bridges the curve and is made of elastic material. US-A-4,633,542 discloses a toothbrush where the ends of individual tufts are moveably mounted with their proximate ends in contact with a flexible membrane. For example US-A-5,373,602 discloses a toothbrush in which the ends of the bristles are set in a rubbery flexible tip extension to the head. US-A-5,454,133 discloses a toothbrush in which the

proximate ends of individual tufts are mounted in contact with a flexible pad or a capsule containing a very soft elastomer or liquid. WO-A-96/02165 discloses a toothbrush in which the tufts are set in a thermoplastic elastomer mount. WO-A-97/36517 discloses a toothbrush head in which bristles are mounted in a flexible pad which is mounted above a longitudinally-extending supporting ridge allowing widthways splaying of the bristles. WO-A-98/35584 discloses a toothbrush head in which the bristle ends are mounted in rigid wells set in an elastomer material. Trisa WO-A-98/43514 discloses a toothbrush head in which bristles in tufts are mounted in holders and are embedded in a soft elastic material. WO-A-00/60980 discloses a toothbrush head in which bristles in tufts have their ends linked by a web which is embedded in a soft elastic material.

Such toothbrush heads in the state of the art are not optimised because the directions in which the flexibly mounted bristles in the head can flexibly move is limited, consequently the adaptation of the bristles to the shape of the teeth is also limited.

It is an object of this invention to provide a toothbrush in which the bristles are flexibly mounted onto the head which overcomes at least in part the problems encountered with the above-mentioned toothbrushes of the state of the art.

Other objects and advantages of the present invention will be apparent from the following description.

According to this invention a toothbrush head, connected to or connectable to a toothbrush grip handle to define a head-handle length direction and a perpendicular width direction is provided, comprising a flexible bristle carrier on which are mounted bristles and having a base part closest to the toothbrush handle when connected and a longitudinally opposite tip part, and a support which supports the carrier;

characterised in that the support supports the carrier at the base part and at the tip part, leaving the carrier unsupported thereby in a region longitudinally between these parts, the carrier being flexible such that it can deform under the forces of toothbrushing so that both its longitudinal and widthways sections become distorted.

The bristles may be made of a conventional bristle material e.g. a polyamide material e.g. nylons such as Tynex™ (DuPont) abovementioned, or polyester. For example nylon monofilaments such as those commercially available from DuPont under the name DuPont Tynex, made from Nylon 512 may be used. Typically the
5 bristles are grouped in tufts containing plural bristles, as conventionally.

Typically bristles may be disposed in tufts containing conventional numbers of bristles and of generally conventional shapes and dimensions. For example tufts may contain 5-100, preferably 10-75, e.g. 30-60 bristles per tuft. Such tufts may for example be of circular or non-circular e.g. longitudinally or widthways elongated
10 cross section, and may have a typical dimension across their length of 0.75 - 5mm. Circular sectioned tufts typically have a diameter ca. 0.9-1.5mm, and may have their ends proximate to the head embedded in the mass of elastomer material to a depth of 0.5 - 5 mm, typically ca. 0.7 - 1.5 mm, for example so that the proximate ends are disposed part way through the thickness of the mass from the bristle
15 surface. Alternatively bristles may be embedded individually rather than plurally in tufts.

The carrier, e.g. the elastomer material pad or the segmented carrier typically has a bristle surface and an opposite surface, the "back face", distant from the bristle face in a thickness direction transverse to the longitudinal direction.
20 There is an edge surface between the bristle surface and the back surface.

In one embodiment the flexible bristle carrier may comprise a pad of an elastic material. This may be an elastomer material, preferably a thermoplastic elastomer material ("TPE"), as such materials can easily be injection moulded and bind with most of the plastics materials used for toothbrush construction. Many such
25 TPE materials are known for use in toothbrushes. A preferred elastomer material has a hardness Shore A 10 - 40, preferably 20 +/- 10, more preferably 20 +/- 5. Some suitable materials are for example those available from Kraiburg Gummiwerk (DE) under the reference numbers RTF 8778, 8728, 8722 and 8725. The pad may have a thickness, i.e. its dimension in the bristle direction, of for example 2.5 to 5
30 mm, typically 3 +/- 0.5mm. An alternative type of elastic material is a visco-elastic material for example a polyurethane gel, for example those available under the name Technogel™. Such a pad may have flat bristle and back faces and be of uniform

thickness, alternatively one or both of the bristle and/or back surfaces may be profiled e.g. with widthways aligned ridges or grooves to concentrate flexibility in pre-determined directions.

5 The bristles, preferably grouped in tufts, may be mounted on such an elastomer material pad in various ways. It may be possible to embed the ends of the bristles directly in the pad. Binding of bristles into an elastomer material pad is preferably achieved by the use of plastics material, e.g. polypropylene, holders in which the tufts are retained e.g. as disclosed in WO-A-97/20484, WO-A-98/35584, WO-A-98/43514, which can bind firmly with the elastomer material and which can
10 retain the bristles in the pad. Each of such holders may retain an individual tuft of bristles or may retain plural tufts of bristles, so that the holder comprises a connecting part between the tufts of bristles. The holders may be connected together only by the elastomer material between them, so that the holders are isolated islands in the elastomer material pad. In one embodiment such holders may be in the form
15 of rings which surround tufts of bristles which extend through them, and which are set in the elastomer material, and which allow some movement of the tufts of bristles reciprocally along the bristle direction, for example as disclosed in applicant's pending European patent application EP 04010962.1 filed 7 May 2004 under applicant's reference CB60856P, the contents of which are incorporated

~~20 herein by reference. In such tufts the ends of the individual bristles may be melted~~
by heat so that they fuse together and then allowed to cool and solidify to form an enlarged mass, and this enlarged mass may be embedded in the elastomer material. Techniques to fuse the ends of toothbrush bristle tufts are known in the art.

An alternative way of mounting tufts of bristles in such an elastomer material
25 pad is disclosed or analogous to the method in WO-A-00/60980 (EP-B-1168943). In this latter disclosure at least some of the bristles are linked together at their ends proximate to the head by a web which is incorporated into the pad of resilient elastomer material. In such a construction the ends of the bristles or tufts may be attached to the web. Such a web typically comprises a flexible, substantially 2-
30 dimensional structure linking the ends of the bristles or tufts. There may be a single web linking all of the tufts or bristles, or a plurality of separate webs each respectively linking independent groups of tufts of bristles. For example the web

may comprise a thin, flexible sheet, lattice, network or mesh of a material to which the ends of the bristles are attached. Alternatively the web may be made integrally of the same material as the bristles.

In an alternative embodiment the flexible bristle carrier may comprise plural plastics material segments which are flexibly linked so as to allow the carrier to be flexible such that it can deform under the forces of toothbrushing so that both its longitudinal and widthways sections become distorted. There may be two or more segments. To achieve deformation under the forces of toothbrushing so that its longitudinal section becomes distorted such segments may be sequentially longitudinally arranged. To achieve deformation under the forces of toothbrushing so that its widthways section becomes distorted such segments may be sequentially widthways arranged. The carrier may for example be divided both along and widthways across its longitudinal direction by flexible links, thereby allowing both its longitudinal and widthways sections to flex under these forces.

Each flexible link between segments may comprise a flexible plastics material bridge which is thinner than the thickness of the segments it links, or may comprise a composite structure of a combination of a flexible plastics material bridge which is thinner than the thickness of the segments it links and an elastomer material, e.g. with the bridge surrounded on one or more side by the elastomer material, or the flexible link may be composed wholly of an elastomer material between the segments it links. It is preferred that such links are constructed to allow the carrier to stretch in its longitudinal direction under longitudinal tension.

In such a head the bristles or tufts may be mounted into the segments in a manner as conventionally used in known toothbrushes with heads comprising plural flexibly linked segments.

The support supports the carrier at a base part adjacent to the base end and at a tip part adjacent to the tip end, leaving the carrier unsupported thereby longitudinally in a region between these parts. Longitudinally between the base and tip parts the support may arch away from the back face of the carrier, in a curved or angular arched shape, e.g. so that the carrier extends in a chord direction between the cusps of the arch. In such a construction a space is left between the back face of the carrier and the support into which the carrier can deform. Typically the length

of the unsupported region of the pad may comprise 50% or more, preferably 75% or more of the overall length between the extreme longitudinal ends of the pattern of bristles on the carrier. For example up to ca. 25% of the length of the pad immediately adjacent to the tip end and up to ca. 25% of the length of the pad immediately adjacent to the base end may be supported by the support. In this construction the side surface of the carrier longitudinally between the supported parts of the carrier may be left unsupported. Typically the pattern of bristles on a toothbrush head has a length ca. 20-30 mm. The space left between the back face of the carrier and the support may have a dimension 0.5 – 7 mm in the direction perpendicular to the longitudinal direction, e.g. 4 +/- 1 mm.

It is preferred that the support is flexible, e.g. capable of resilient bending deformation in its longitudinal direction, and/or capable of resilient twisting deformation about a generally longitudinal twist axis. A flexible support having such modes of deformation assists the flexible deformation of the bristle carrier. Bending deformation of the support in its longitudinal direction can compress the carrier longitudinally to cause the bristle face of the carrier to shorten so that the bristles are closer together and denser packed, and can cause the bristle face of the carrier to adopt a longitudinally concave shape. Bending deformation of the support in its longitudinal direction can alternatively stretch the carrier longitudinally to lengthen the bristle face, or cause the bristle face of the carrier to adopt a longitudinally convex shape with splayed bristles. Twisting deformation of the support about a generally longitudinal twist axis can help the bristle face of the carrier to adapt more readily to the shape of the user's teeth and gaps between the teeth.

The gap between a flexible support and the carrier may be sufficiently small that if the flexible carrier deforms so as to be convex on its side facing in the bristle direction the convex side of the support can contact the back face of the carrier and cause the carrier to also adopt a shape in which the bristle face is convex. This can cause the bristles to splay.

A flexible support may be achieved by a support comprising longitudinally distanced support parts to respectively support the base part and tip part of the carrier, integrally longitudinally linked by one or more flexible plastics material link. The support parts may be adapted to support the carrier, e.g. comprising a

cavity in which the carrier may fit, and may be provided with engagement features to enhance bonding between the carrier and support. The one or more link may define the arched shape of the support. Such a link may be in the form of a thin plastics material rib extending generally longitudinally. There may be a single link
5 or plural links. For example plural links may be disposed on opposite sides of the central longitudinal direction of the head and may be in a generally "V" shape pointing away from the handle. For example a link may be of a generally "Y" shape with the stem pointing away from the handle.

The support, i.e. the support parts, link(s) etc. may be made of a plastics
10 material as commonly used in toothbrush manufacture, e.g. polypropylene ("PP"), polyamide ("PA"), acrylonitril butadiene styrene ("ABS") etc. and may be integrally made with the toothbrush handle.

Other parts of the toothbrush for example the toothbrush handle may be of generally conventional construction. For example the handle may incorporate one or
15 more "S" bends as disclosed in EP-A-0 336 641. Additionally or alternatively the toothbrush may incorporate flexible links at other places in its structure, for example between its head and the immediately adjacent part of its handle, i.e. its neck, e.g. as disclosed in WO-A-92/17092 or WO-A-97/24949.

The toothbrush head, and the entire toothbrush of this invention may be
20 made by generally known two-component injection moulding processes in which firstly the plastics material part(s) of the toothbrush are made, then the so-formed plastics material part is enclosed in a second mould cavity and an elastomer material is injected into the mould cavity and caused to bond with the plastics material in a known manner. Bristles may be set in the carrier in a generally known process. For
25 example a tuft of bristles may be provided threaded through a ring of a plastics material which binds to the elastomer material (which may be the same plastics material as other parts of the toothbrush) with the end of the tuft to be set in the head fused together to form an enlarged mass, this end may be introduced into a mould cavity and the elastomer material injected therein to bind the plastics
30 material.

The invention will now be described by way of example only with reference to the accompanying drawings in which:

Fig. 1 shows a plan view of a toothbrush head of this invention.

Fig. 2 shows a longitudinal section through the toothbrush head of Fig. 1.

Fig. 3 shows a cross section through the toothbrush head of Fig. 1.

Figs. 4 and 5 show the support used in the head of Figs. 1, 2 and 3.

5 Figs. 6, 7 and 8 show deformation of the head of Figs. 1 to 5.

Figs. 9, 10 and 11 show an alternative construction of toothbrush head of this invention.

Referring to Figs. 1, 2 and 3 the head 10 (overall) of a toothbrush of the invention is shown. The head 10 is connected to a toothbrush grip handle 11 only
10 the part of which adjacent to the head 10 being shown, to define a head-handle longitudinal direction L - - L and a perpendicular width direction W - - W.

Head 10 comprises a flexible bristle carrier 12 in which are mounted tufts 13 of plural bristles extending in bristle direction B only one of which is shown for clarity, but of which a plurality is disposed in a pattern over the bristle face 14 of
15 the carrier 12 and from which the bristles 13 extend. The carrier 12 has a base part 12B closest to the toothbrush handle 11 and a longitudinally opposite tip part 12C.

Bristle carrier 12 comprises a pad of a thermoplastic elastomer material ("TPE") such as that available from Kraiburg Gummiwerk (DE) under the reference numbers RTF 8778, 8728, 8722 or 8725. The pad 12 has a thickness in the bristle
20 direction B of ca. 3mm.

Tufts 13 are mounted on the elastomer material pad 12 by the use of plastics material holders 15 in each of which the end of a tufts 13 is retained and which is set in the elastomer material of pad 12, binding therewith. The holders 15 are connected together only by the elastomer material between them, so that the holders
25 15 are isolated islands set in the elastomer material pad 12.

The carrier 12 is supported at its base part 12A and at its tip part 12B by a support 16, leaving the carrier 12 unsupported thereby in a region 12C longitudinally between these parts 12A, 12B. The length of the unsupported region 12C of the pad 12 comprises some 75% or more of the overall length between the
30 extreme longitudinal ends of the pattern of bristles 13 on the carrier. It is seen that up to ca. 25% of the length of the pad 12 immediately adjacent to the tip part 12B and up to ca. 25% of the length of the pad 12 immediately adjacent to the base part

12A are supported by the support 16. The support 16 comprises longitudinally distanced support parts 17, 18 to respectively support the base part 12A and tip part 12B of the carrier 12, integrally longitudinally linked by a flexible plastics material link 19 (overall) in the form of thin plastics material ribs 19A, 19B, 19C extending generally longitudinally.

The support 16 and handle 11 are integrally made of a plastics material (e.g. polypropylene ("PP"), polyamide ("PA"), acrylonitril butadiene styrene ("ABS") etc.

Longitudinally between the base and tip parts 12A, 12B the support 16, i.e. the link 19 of the support 16 arches away from the back face 110 of the carrier 12 in a direction opposite to the bristle direction B. This leaves a space 111 ca. 4 +/- 1 mm wide between the back face 110 of the carrier 12 and the link 19 part of the support 16 into which the carrier can deform under the influence of pressure on the bristles 13 during toothbrushing. This deformation of carrier 12 under the influence of pressure applied in the direction of the bold arrow is shown more clearly in Fig. 6. The side surfaces 12C, 12D of the carrier 12 longitudinally between the supported parts 12A, 12B of the carrier 12 are left unsupported by the carrier, as is more clearly seen in the cross section Fig. 3. This lack of support allows the deformation of the carrier 12 as shown in Fig. 7 under the influence of pressure at the point indicated by the bold arrow, which may occur simultaneously with the deformation shown in Fig. 6 so that the bristle face 14 can deform 3-dimensionally to adjust the bristles 13 to the curved surface of the teeth.

The support 16, in particular the link 19, is flexible, being capable of resilient bending deformation in its longitudinal direction, i.e. of bending about a bend axis parallel to the width direction W- -W. In such deformation the frame 16 may bend into a more tightly curved arch shape to thereby compress the carrier 12, or flatten into a less tightly arched shape to stretch carrier 12. Fig. 6 also shows how downward pressure acting on the tip part 18 of the head as shown by the bold dashed arrow can cause the support 16 to bend relative to parts of the support 16 closer to handle 11, about a bend axis parallel to the width direction W- -W, so that the tip part moves downwards in the direction of the light dashed arrow shown. Pressure in the opposite direction causes an opposite bending deformation. Fig. 8

shows resilient twisting deformation of the link 19 about a twist axis generally aligned with the longitudinal direction L- -L, accompanied by a twisting deformation of carrier 12.

5 The carrier 12 is bonded to the parts 17, 18 by bonding of known type between the plastic material of the support 16 and the thermoplastic material of the support 16. However support parts 17, 18 are also shown provided with engagement holes 112 which are wider at the outer surface of the support 16, so that the material of the pad 12 passes through these holes 112 to form a "mushroom head" at the outer surface so that the material of the pad 12 engages with the support 16. The support parts 17, 18 are also define cavities 113 in which the pad 16 sits, the sides of the cavities 113 providing an area for bonding between the elastomer material of the pad 16 and plastics material. The support parts 17,18 may be provided with additional or alternative structural features (not shown) to enhance engagement and/or bonding between the pad 16 and support parts 17, 18.

15 Referring to Figs 9, 10 and 11, views analogous to Figs. 1, 2 and 3 are shown of a toothbrush head 20, Fig. 10 showing a longitudinal section cut along line A- -A, corresponding parts being numbered correspondingly. In this toothbrush however the flexible bristle carrier 21 comprises plural plastics material segments 21A, 21B, 21C, 21D. The carrier 21 is divided both along and widthways across its longitudinal direction by flexible links 22 aligned across head 20, and links 23 aligned longitudinally, and which comprise a filling of an elastomer material between the segments 21A, 21B, 21C, 21D, and which allow the carrier to be flexible such that it can deform under the forces of toothbrushing so that both its longitudinal and widthways sections become distorted. The pairs of segments 21A, 21D and 21B, 21C are longitudinally disposed, and the pairs of segments 21A, 21B and 21C, 21D are widthways disposed. Although in these drawings only two segments are shown longitudinally disposed there may be three or more. Although in these drawings only two segments are shown widthways disposed there may be three or more. Tufts of bristles 24 (only shown in segment 21A for clarity) are conventionally mounted. The support 16 comprises a link 19 which is flexible analogously to the link 19 of Figs 1 - 8 and can bend and twist analogously to that

link to allow deformation of the carrier 20. In Fig. 11 deformation of the widthways section of the carrier 21 and twisting of the flexible link 19 is shown.

Claims.

1. A toothbrush head, connected to or connectable to a toothbrush grip handle to define a head-handle length direction and a perpendicular width direction,
5 comprising a flexible bristle carrier on which are mounted bristles and having a base part closest to the toothbrush handle when connected and a longitudinally opposite tip part, and a support which supports the carrier;
characterised in that the support supports the carrier at the base part and at the tip part, leaving the carrier unsupported thereby in a region longitudinally
10 between these parts, the carrier being flexible such that it can deform under the forces of toothbrushing so that both its longitudinal and widthways sections become distorted.
2. A toothbrush head according to claim 1 characterised in that the flexible
15 bristle carrier comprises a pad of an elastic material.
3. A toothbrush head according to claim 2 characterised in that the elastic material is a thermoplastic elastomer material.
- 20 ~~4. A toothbrush head according to claim 1 characterised in that the flexible~~
bristle carrier comprises plural plastics material segments which are flexibly linked so as to allow the carrier to be flexible such that it can deform under the forces of toothbrushing so that both its longitudinal and widthways sections become distorted.
- 25 5. A toothbrush head according to claim 4 characterised in that the flexible bristle carrier comprises segments sequentially longitudinally and sequentially widthways arranged.
- 30 6. A toothbrush head according to any one of claims 1 to 5 characterised in that between the base and tip parts the support arches away from the back face of the carrier such that a space is left between the back face of the carrier and the support into which the carrier can deform.

7. A toothbrush head according to any one of claims 1 to 6 characterised in that the side surface of the carrier longitudinally between the supported parts of the carrier is left unsupported.

5

8. A toothbrush head according to any one of claims 1 to 7 characterised in that the support is flexible.

9. A toothbrush head according to claim 8 characterised in that the support is
10 capable of resilient bending deformation in its longitudinal direction, and/or capable of resilient twisting deformation about a generally longitudinal twist axis.

10. A toothbrush head according to claim 8 or 9 characterised in that the support
15 comprises longitudinally distanced support parts to respectively support the base part and tip part of the carrier, integrally longitudinally linked by one or more flexible plastics material link.

11. A toothbrush head according to claim 10 characterised in that the one or
20 more link defines the arched shape of the support and is in the form of a thin plastics material rib extending generally longitudinally.



